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The JOURNAL of GEOGRAPHY

VOLUME XX MAY, 1921 NUMBER 5

AGRICULTURAL METEOROLOGY[1]

J. WARREN SMITH
United States Weather Bureau, Washington, D. C.

Agricultural meteorology may be defined as "meteorology in its relation to agriculture." It considers the vegetation and animal life of the globe, the distribution of food and other crops, and farm operations as affected by climate. It shows the effect of weather on the growth and yield of crops. It treats of the influence of climate and weather on insect activities, the development of plant diseases, and the protection of crops, animal life, and buildings from damaging meteorological phenomena.

There is an optimum combination of temperature, moisture, and sunshine in which plants make their best growth, and under which the largest yields will be obtained. Food is available to the roots of plants only in a soluble form; it is carried into the plants and converted into vegetable tissue under the influence of solar energy expressed in heat units or calories.

If there is not enough moisture to furnish sufficient soluble plant-food, part of the solar energy is wasted, while on the other hand if there is more food brought to the roots than the solar energy can utilize, the food material is wasted.

Different plants require unlike proportions of moisture, heat, and sunshine, and most plants require varying amounts at different stages of development. Many plants have a certain (frequently short) period during growth when there must be a well-defined combination of certain weather factors to produce large yields; others have the ability to stand nearly dormant when unfavorable conditions prevail, but will revive and make excellent growth when the weather factors are in correct proportion.

AGRICULTURAL CLIMATOLOGY

The branch of agricultural meteorology which deals with the relation of climate to vegetation and farm operation is called "agricultural

[1] This article is an abstract of portions of Dr. Smith's "Agricultural Meteorology," and is published together with all the illustrations, by permission of the Macmillan Company. Editor.

climatology." The climate largely determines the vegetation natural to a region, the kind of crops that can be grown profitably and, therefore, the types of farming, and in a general way the characteristics of the people who live in any region.

Temperature

The temperature is the most important factor in determining the flora and the general zones of vegetation and the location of the most important food plants. Experiments indicate that the higher forms of plants cannot grow where the temperature remains continuously below 32° or above 122°, while most food plants can thrive only within much narrower ranges. Wheat and corn are grown within a belt where the mean annual temperature is between 39° and 68°; oats and barley, 28° to 68°; rice, 68° to 86°; and potatoes, 35° to 61°.

Most annuals grow continuously during a certain period of the year and either die or mature when it becomes too cold or too warm. A few become dormant when unfavorable temperatures obtain, resuming and finishing growth when more favorable temperatures prevail. The months when the mean daily temperature is between 49° and 72° are considered periods of growth for most crops in the United States. Figure 1 shows the dormant or rest periods for most crop plants in the United States.

FIGURE 1. Chart showing the average time, in months, in which plant life in general, remains more or less dormant. It is based on the average period between the first month in the fall and the last in spring, with a mean temperature below 49°F.

The temperature of the soil affects the germination and growth of plants and the development of some plant diseases, to a marked degree. The most favorable temperature for growth is between 65° and 70°. Soil bacteria do not become active until the temperature of the soil reaches 45° or 50°. A thick snow-cover is a most efficient agent for keeping the soil warm in winter and preventing it from attaining extreme low temperature during severe weather.

Precipitation

After temperature the next most important climatic factor is the moisture, either as water-vapor or as water in the form of rain or snow. The rainfall determines the productiveness of a country. In places where the temperature and sunshine are generally sufficient, the development of the plants and more especially the crop yields depends most largely on the rainfall. Figure 2 shows the average annual precipitation (rain and melted snow) in the United States.

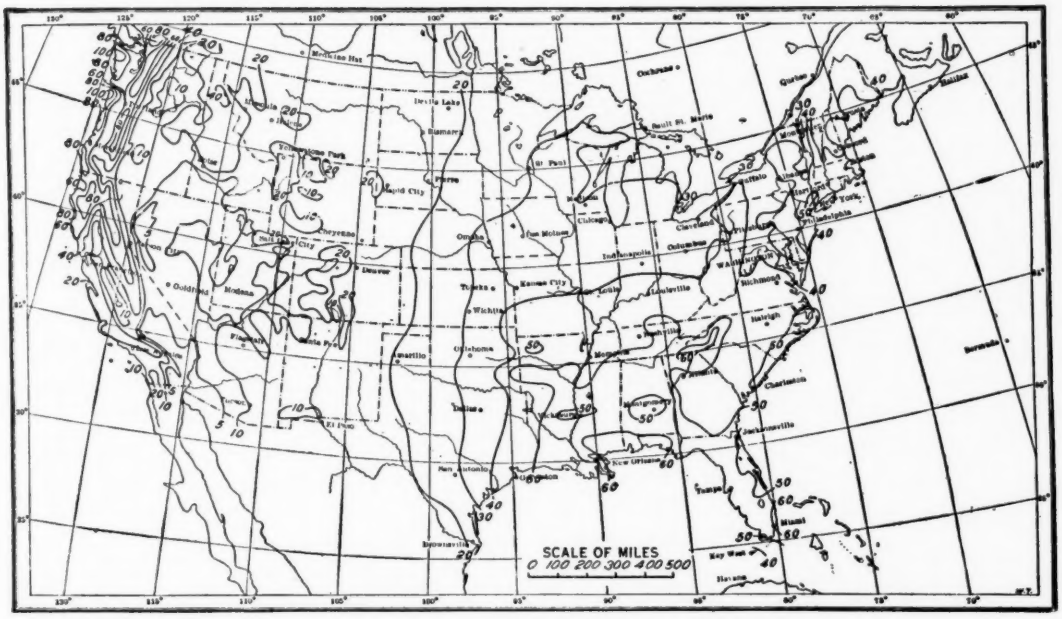

FIGURE 2. Annual precipitation in the United States.

There was a time when water was thought to be the real food of plants, but with experiments it became obvious that the influence of rainfall on plant growth is exerted in replenishing the moisture in the soil. A plentiful water supply as a rule favors the development of the vegetative organs, while a scarcity of water brings about their reduction. On the contrary, the production of the sexual organs is usually

favored by a lack of water and impeded by an excess. The amount of water in the soil affects the activity of soil bacteria.

There is no direct relation between the percentage of water present in the soil and the amount that is available for plant use. A sandy soil with 15 per cent of moisture may be near saturation and have a large amount of available water while a stiff clay with 15 per cent of moisture may have so little available water that all plants will wilt in it. There is a wide difference in the wilting coefficient of different soils, while the wilting coefficient for any soil is practically the same for all crops.

Transpiration is the term used to express the loss of water from the surface of the aerial parts of plants. The maximum transpiration is at the warmest part of the day. On days of extreme temperature there may be an atmospheric demand of ten pounds of water from a single corn plant during 24 hours. The greatest part of this need is for a period of about seven hours in the hottest part of the day; such days are very critical if there is not moisture enough in the soil to supply the demand. Corn curls and wilts when the transpiration exceeds the absorption thru the roots.

It is not often that a crop has during its entire life just the quantity of water that best serves its need, altho there is no such thing as a definite water requirement which is constant for any one kind of plant. A plant requires different amounts at separate periods of growth and under varying conditions of temperature, wind, and sunshine. The grain crops require less water in the early part of the growth than during the period when the heads and kernels are forming. The transpiration of annual crops rises to a maximum a little beyond the middle of the growth period and then decreases until harvest.

Sunshine or Light

Next to moisture, light is the most important external factor affecting the form of plants. In some places where the rainfall is sufficient but the temperature is too low for the best growth of plants, as in Alaska and at high altitudes, sunshine becomes the most important climatic factor.

The action of light on plants may be invigorating or retarding, beneficial or detrimental, depending on its intensity and the precise physiological functions involved. Other things being equal, an increased amount of sunshine means a larger quantity of sugar and starches.

The relative length of the day is a factor of the first importance in the growth and development of plants, particularly with respect to sexual reproduction. It has been found that normally plants can

attain the flowering and fruiting stages only when the length of day falls within certain limits, and consequently, these stages of development ordinarly are reached only during certain seasons of the year.

Wind

Wind is an important climatic element and the factors considered are its velocity or total movement, prevailing direction, and the character of the country from which the wind blows. Wind may be beneficial or damaging.

CLIMATE AND FARM OPERATIONS

Climate is the most fundamental of all the factors which determine crop distribution and hence farming methods. East of the Rocky Mountains the agricultural provinces have more or less definite climatic boundaries, extending in an east-west direction, conforming to the isothermal trend. In this region there are five fairly distinct provinces, as follows: (1) the southern subtropical coast where the principal crops are winter truck, citrus fruits, sugar-cane, and rice; (2) the cotton belt where cotton forms about 47 per cent of the acreage and 61 per cent of the value of all crops grown in the belt; (3) the corn and winter wheat belt where there is diversified farming, but corn usually contributes nearly 45 per cent and wheat nearly 15 per cent to the acreage of all crops; (4) the spring wheat belt where spring wheat forms 36 per cent of the crop acreage; (5) the hay and pasture region where the dairy products amount to more than one-half of the total for the United States.

It is climate therefore that causes over 75 per cent of the cultivated land in the Southern States to be given to intertilled crops, while over 90 per cent of the cultivated land in the Northwest is devoted to broadcast crops. Further, climate is responsible for a harvest value of $10 to over $20 per acre from crops in parts of the Mississippi and Missouri valleys, as compared with less than ten cents per acre over some areas in the far Southwest.

In order to be entirely successful in farm operations a man must know and take account of the degree of risk that he runs from climatic conditions in raising any crop. He must calculate the risk of loss by rains and low temperatures, the average length and intensity of drought periods, the probability of hail and wind damage, and the danger of frost in the spring and fall.

THE EFFECT OF WEATHER ON CROPS

Plant growth is the result of so many different factors and these influences have such complex combinations that it naturally has been deemed difficult if not impossible to determine the relation to, or influence of, any one of these factors in varying the yield of a crop.

While it may never be possible to determine the exact influence of any particular weather factor at any specified period of growth, it is believed to be entirely feasible to learn which weather element has the greatest influence in varying the yield or what combination of weather factors is most favorable or unfavorable at certain periods of growth.

Cotton

Cotton is of tropical origin but is now grown in many places as far north as 40° north latitude and south to 30° south latitude. It is a perennial shrub in the tropics but as it is killed by frost the seed must be planted annually in the temperate districts. Fully 60 per cent of the world's production of cotton is grown in the United States.

Cotton is a slow growing crop and seldom matures in less than 180 days after the seed is planted. Very little is grown in the United States where there are less than 200 days between the average dates of killing frosts. Temperature is the principal limiting factor controlling the geographic distribution of cotton. It cannot successfully be grown commercially where the mean summer temperature is below 77° or 78°. There is a rather close relation between the temperature during the early period of growth and the time of maturity.

Cotton needs a moderate but regular supply of moisture, hence light frequent showers with plenty of sunshine between produce the best condition for growth. An over-supply of moisture causes too rank a growth at first, deferring the fruiting and causing a development of vegetative limbs instead of the fruiting branches. Rainy and cold weather early in the season hinders the preparation of the soil and the planting of the seed and its proper germination. Excessive rainfall in the first part of the season not only prevents proper cultivation but encourages shallow root development; dry and hot weather later in the season is very detrimental.

In the central and eastern portions of the cotton belt April, May, and June should be warm and moderately dry for best results. In Texas, however, low yields have been more frequent with a dry April than when the April rainfall has been above the normal. In general the yield of cotton is largely affected by the rainfall during the months

of July and August, especially in the western part of the belt. Subnormal rainfall during these months is more frequently harmful in the western portion than in the central and eastern, owing to the normally greater amounts received in the latter district.

Corn

Corn or maize is a sun-loving crop of tropical origin, but it is so flexible in its requirements and so readily adapts itself to its surroundings that it is successfully grown over wide climatic ranges. Except where irrigation is practiced, most corn is grown in regions having an annual rainfall of over 20 inches and a summer temperature averaging about 75°.

Corn is preëminently an American crop and is grown on three-fourths of all the farms in the United States. Every fourth acre, almost, of improved land in this country is a corn field. Figure 3 shows the distribution of corn growing in this country.

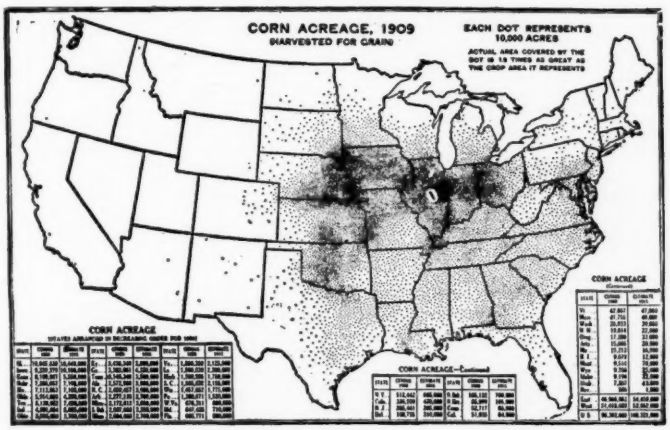

FIGURE 3. Where corn is grown in the United States.

The growth of corn in any quantity is limited on the north by the mean summer isotherm of 66° and by the average summer night temperature of 55°. The western limit of extensive cultivation agrees closely with the summer rainfall line of eight inches.

Rainfall is the most important weather factor in varying the yield of corn in the corn-belt district of the United States and July is the most important calendar month. Figure 4 indicates the relation between the rainfall during the month of July and the average yield of corn, over the States of Indiana, Illinois, Iowa, and Missouri. In this

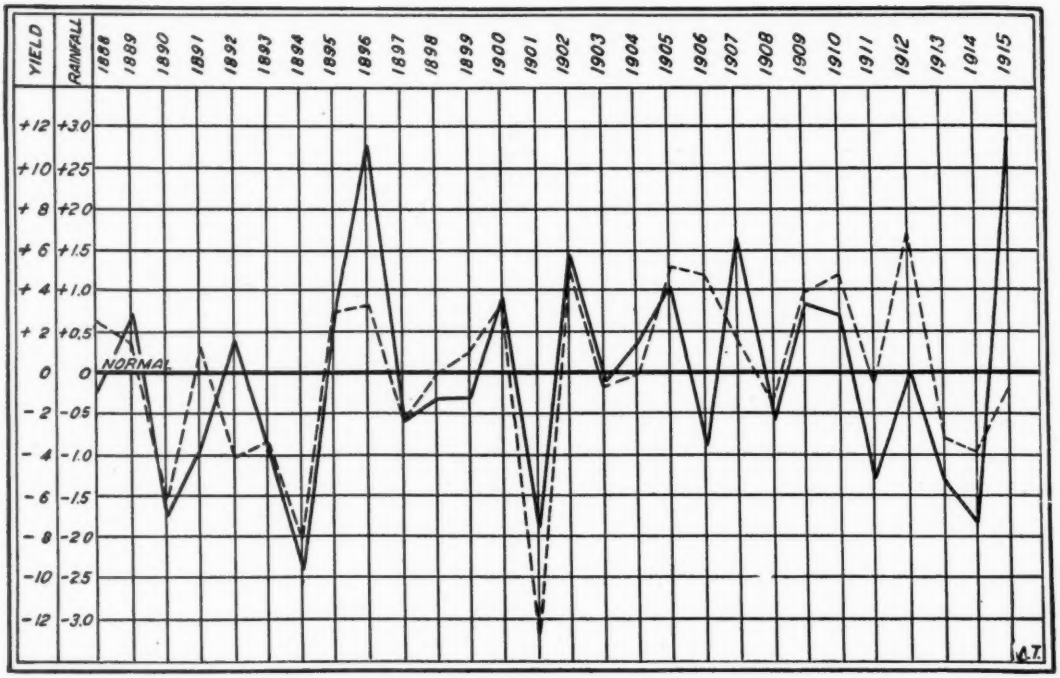

Figure 4. Relation between the July rainfall and the yield of corn in four states, 1888-1915.

diagram the broken line shows the yield of corn in bushels per acre while the solid line shows the average rainfall in inches.

While the two curves are fairly uniform, there are some variations which show plainly that other weather factors must be taken into account. However, when the rainfall was above the normal, the yield was above the normal in every year but two. This shows a probability of the yield of corn being above the normal 85 per cent of the time when the rainfall in July is greater than the average. An inspection of the curves shows also that in only four of the years when the rainfall was below the normal was the yield greater than the average. This makes a probability of 73 per cent that the yield of corn will be below the normal if the rainfall for the month of July is less than the average.

A complete analysis of the rainfall and yield data in these States shows that whenever the rainfall in July has averaged between 2.0 and 2.5 inches, the yield of corn has averaged 23 bushesl per acre. Also that when the rainfall has been between 2.5 and 3.0 inches the yield has averaged 33 bushels per acre. This is an increase of 10 bushels of corn to the acre, on the average, with an increase of only one-half inch in the rainfall, or an increase of fully 300,000,000 bushels in these four states.

Similar studies for the eight greatest corn states for the same period as well as in Ohio for the period from 1854 to 1915 show the same influence of the July rainfall in varying the yield. In Ohio when July averages warm and wet the probability of the yield of corn being above the average is 85 per cent, while it is 73 per cent if the month is cool and wet. On the other hand, when July is cool and dry, the probability of a good corn yield is only 38 per cent, and when the month is warm and dry it is only 33 per cent.

A more detailed study shows that the most important short period in the growth of the corn crop is during the ten days following blossoming and that there must be an abundance of moisture during this period. This establishes the critical period in the growth of corn when favorable weather practically insures a good yield of corn and unfavorable weather will give a poor yield by far the greater portion of the time. In the western Plains States, however, hot winds and severe drought later in the season will reduce the crop even tho the conditions may be favorable at blossoming time.

Wheat

Wheat is the great bread cereal of the moderate temperate climates. The important winter wheat district in the United States is from the Central Plains eastward to the Middle Atlantic coast. The principal spring wheat region is in North Dakota, South Dakota, and Minnesota. The dividing line between the principal spring and winter wheat producing areas east of the Rocky Mountains agrees closely with the mean winter temperature line of 20°. The southern border of the winter wheat belt agrees closely with the isotherm of 68° for the two months preceding the date of harvesting. Most of the important wheat districts of the world have an annual precipitation of less than 30 inches.

All authorities agree that the wheat plant must have an abundance of moisture at the heading stage. Some have placed the most critical stage just as the plants are beginning to head, others between the boot and bloom periods, and still others between the bloom and milk stages. High temperature and lack of moisture while in bloom produce sterile heads. Hard wheats are best adapted to central and western Kansas, while soft wheat is better in eastern Kansas.

Spring wheat is grown in regions where the winters are cold and comparatively dry and where there is little snow for the protection of winter grains. Figure 5 shows the favorable influence of rainfall in May and June on the yield of spring wheat in North Dakota. This indicates that relatively dry weather during these months is almost

invariably followed by a low yield of wheat, while an abundant rainfall is usually followed by a good yield. In addition the month of June should be cooler than the normal to secure the best yields.

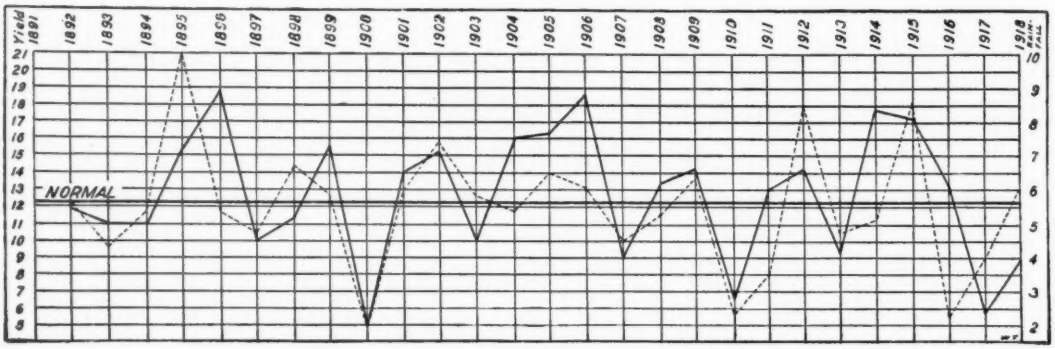

FIGURE 5. Relation of rainfall in May and June to yield of spring wheat. North Dakota, 1891-1918.

It has been found in Manitoba, Canada that if in the earlier stages of growth it is cool and rainy, the heading of spring wheat will be delayed and the yield increased, but if it is warm and dry, heading is hastened and the yield will be light.

Studies in Ohio covering fifty-three years show that warm weather in March is decidedly favorable for winter wheat, while a heavy snowfall in that month is decidedly detrimental. Figure 6 shows the effect of heavy March snowfall in Fulton County in northwestern Ohio.

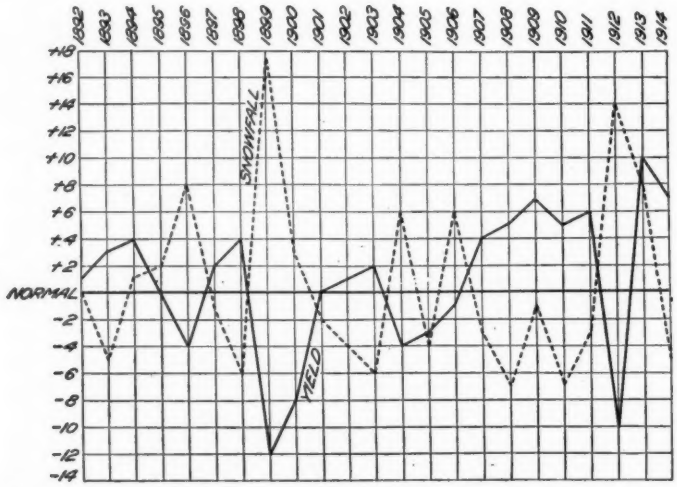

FIGURE 6. Relation between the snowfall in March and the yield of winter wheat in Fulton County, Ohio, 1892-1914.

Winter damage to fall sown grains is usually grouped under the heads of (1) heaving, (2) smothering, (3) direct effect of low temperatures on the plant tissue and protoplasm, and (4) physiological drought.

Vegetables

Vegetables are usually classified as "hardy" and "tender," but a better grouping would be as "cool" and "warm" weather crops. These groups might be further classified in regard to their varying needs of moisture, sunshine, and temperature.

Under the general head of warm weather crops should be placed cantaloupes, cassava, castor beans, cucumbers, eggplants, gerkins, muskmelons, okra, peanuts, pepper plants, pumpkins, squashes, sweet potatoes, tomato plants, and watermelons.

The cool weather crops will include beans, beets, cabbage, carrots, cauliflower, celery, chard, collards, kale, kohlrabi, lettuce, mustard, onions, parsley, parsnips, peas, radishes, rhubarb, salsify, spinach, white potatoes, and turnips.

FIGURE 7. Planting zones for vegetables in the eastern half of the United States. While these are the best dates, earlier and later plantings can be made with fair chance of success.

Figure 7 shows the approximate dates for planting vegetables which may be followed with a reasonable degree of safety. The lines and zones are based on the last killing frost in the spring for the earliest plantings, and on the average dates of the first killing frost in the fall for the latest dates.

TABLE I. PLANTING DATES BY VEGETABLE GROUPS

Zone	Group 1	Group 2
A	Jan. 1 to Feb. 1	Feb. 1 to Feb. 15
B	Feb. 1 to Feb. 15	Feb. 15 to Mar. 1
C	Feb. 15 to Mar. 1	Mar. 1 to Mar. 15
D	Mar. 1 to Mar. 15	Mar. 15 to Apr. 15
E	Mar. 15 to Apr. 15	Apr. 15 to May 1
F*	Apr. 15 to May 1	May 1 to May 15
G†	May 1 to May 15	May 15 to June 1

Zone	Group 3	Group 4
A	Feb. 15 to Mar. 1	Mar. 1 to Mar. 15
B	Mar. 1 to Mar. 15	Mar. 15 to Apr. 1
C	Mar. 15 to Apr. 1	Apr. 1 to Apr. 15
D	Apr. 1 to May 1	May 1 to May 15
E	May 1 to May 15	May 15 to June 1
F*	May 15 to June 1	May 15 to June 15
G†	May 15 to June 15	

*For the crops grown.

†Season too short for this group.

Group 1. (May be planted two weeks before the average date of last killing frost.) Early cabbage plants from hotbed or seed-box, radishes, collards, onion sets, early smooth peas, kale, early potatoes, turnips, and mustard.

Group 2. (May be planted about the average date of the last killing frost.) Beets, parsnips, carrots, lettuce, salsify, spinach, wrinkled peas, cauliflower plants, celery seed, onion seed, parsley, sweet corn, and Chinese cabbage.

Group 3. (Should be planted two weeks after the average date of last killing frost.) Snap beans, okra, and tomato plants.

Group 4. (Cannot be planted until ground is well warmed up; about a month after last hard frosts.) Lima beans, pepper plants, egg plants, cucumbers, melons, squash, and sweet potatoes.

White or "Irish" Potatoes

Potatoes rank first as a world food crop on the basis of actual pounds produced, altho more people depend on rice as a staple article in the daily ration. The planting of early potatoes begins when the mean daily temperature in the spring rises to about 45°.

The white potato is a cool-weather crop. It originated in Peru, South America, where the crop is grown at the present time at an elevation sufficiently high to make the average annual temperature about 52°. Production in the United States has reached its greatest development where the mean annual temperature is between 40° and 50° and where the mean temperature of the warmest month is not over 70°. The greatest yields per acre are in those states where the

mean annual temperature is below 45° and where the mean of the warmest month is not far from 65°. Potatoes are a winter crop in the extreme southern districts.

At the Maine Experiment Station it was found that it takes about 425 tons of water to grow one ton of dry matter of potatoes and therefore that a crop of 200 bushels to the acre will require approximately 650 tons of water. Investigations in northeastern Colorado as well as in Utah determined that the weight of water absorbed during the growth of potatoes to the weight of dry matter produced was close to 450. The weight of water falling on one acre of land to the depth of one inch is 112.7 tons. Hence if the growing plants could use all of the water, it would require a rainfall between five and six inches between planting and harvesting to raise a crop of 200 bushels. The actual record of the rainfall in much of the country between planting and harvesting of the early potato crop is between eight and ten inches.

The following table shows the effect of rainfall or temperature on the yield of potatoes in Ohio:

TABLE II. CORRELATION BETWEEN THE RAINFALL AND TEMPERATURE AND THE YIELD OF POTATOES IN OHIO, 1860 TO 1914

PERIOD	RAINFALL		TEMPERATURE	
	Correlation coefficient	Probable error	Correlation coefficient	Probable error
April	−0.21	±0.09	.....	.....
May	0.06	±0.10	−0.10	±0.09
June	0.10	±0.09	−0.22	±0.09
July	0.33	±0.08	−0.51	±0.07
August	0.22	±0.09	−0.31	±0.08
September	−0.13	±0.09	−0.21	±0.09
October	0.07	±0.10	−0.11	±0.09
June and July combined	.....	.....	−0.50	±0.07
July and August combined	0.37	±0.08	−0.50	±0.07
June, July, August combined	.....	.....	−0.49	±0.07

Remembering that the correlation coefficient[1] should be at least three times the probable error to indicate an appreciable effect and that if it is six times the probable error there is plainly considerable relation shown, it will be seen at once that the rainfall in Ohio is not a dominating factor in varying the yield of potatoes, when considered by calendar months.

[1] For meaning of "correlation coefficient" and method of its determination see the author's textbook "Agricultural Meteorology," Macmillan Co. Editor.

The last two columns of the table show, however, that the yield is affected by the temperature variation and that the summer should be cooler than the normal. The highest correlation between the July temperature and the potato yield is -0.51 for July and this is more than seven times the probable error.

Figure 8 shows graphically the relation between the temperature and rainfall combined in July and the yield of potatoes in Ohio. It makes plain that cool weather is most desirable, while a warm July is nearly always followed by a poor yield.

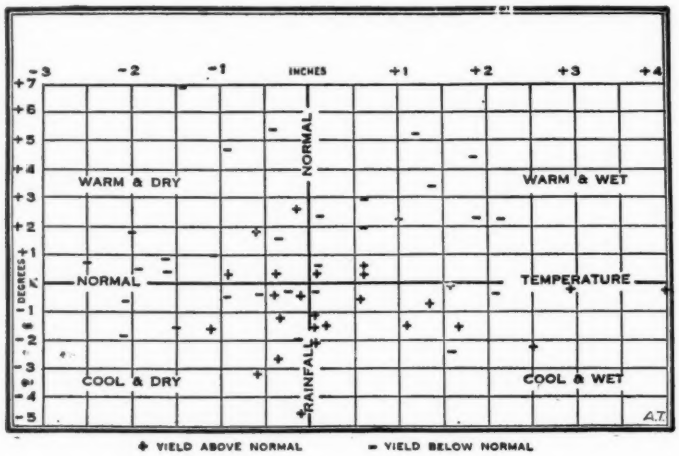

FIGURE 8. The combined effect of the July temperature and rainfall on the yield of potatoes in Ohio, 1860-1915.

If only those years are considered when the temperature variation is one degree or more from the normal it is found that when July is warm the probability of a good potato crop is only 12 per cent, while when July is cool the probability of the potato crop being greater than the average is 77 per cent. A more detailed study of the data shows that for every increase in the average temperature for the month of July of 1.6°, the value of the potato crop in Ohio is reduced, on the average, $4 an acre.

A close study of the diagram in Figure 8 shows that when July is warm and wet the probability of a good potato yield in Ohio is only 23 per cent; when the month is warm and dry, 29 per cent; when cool and dry, 50 per cent, and when cool and wet the probability of the yield being above the normal is 80 per cent.

In the state of New Jersey there has been an average difference of 25 bushels of potatoes to the acre depending on whether the month of

July was appreciably warmer or cooler than the normal, the larger yields being with the lower temperature.

It has been found that the weather during the ripening period has a large effect on the viability of the seeds, and that the development of damaging insect pests and plant diseases is influenced to a large extent by the prevailing weather conditions.

A preliminary study covering a comparatively small district in Ohio shows that the weather during the month of June has as large an effect on the yield of apples the *next* year as that of any of the following 16 months.

Surely climate and weather are dominating factors in the agricultural and business life of every community and the study of these factors and relations are worthy of our closest attention.

SOME GEOGRAPHIC FACTORS IN THE DEVELOPMENT OF CHICAGO

FRED K. BRANOM
Geography Department, Chicago Normal College

WHY IS CHICAGO?

During the last 100 years, Chicago has advanced from a town of approximately three-eighths of a square mile and a population of about fifty, to a city of a little more than 200 square miles and a population of a little less than 3,000,000. What has caused this marvelous growth which has placed Chicago second among the cities of the United States in population and at least fourth and possibly third among the cities of the world?

EARLIEST VISITORS

Long before Columbus sailed for the New World, the Indians passed between the St. Lawrence and the Mississippi River Valleys by way of the Great Lakes, the Chicago River and the Des Plaines River. This was the most natural route, and the present site of Chicago was probably a camping place for Indians passing not only between the St. Lawrence and the Mississippi Valleys, but also for Indians going in either direction around Lake Michigan.

Among the early white men to visit the Chicago region were Marquette and Joliet upon their return from their journey down the Mississippi to the mouth of the Arkansas River. Marquette spent the next winter in a cabin on the South Branch of the Chicago River. However, before this time French-Canadian traders probably had visited this area.

The Chicago River, which flowed into Lake Michigan, was for many years the most important factor in the development of Chicago. It rose in a low, swampy region where also rose the Des Plaines River, a branch of the Illinois River. During high water, small boats could pass from the Des Plaines into the Chicago River and then into Lake Michigan. During low water, a portage of a few miles separated the two rivers. Hence this became the natural route of the Indians, the explorers, the missionaries, the trappers and the traders, and later it was followed by immigrants, wagon roads, canals and railroads.

EARLIEST SETTLERS—FUR TRADERS

Probably no known person actually can be called the earliest settler in Chicago, for French-Canadian traders passed in and out of the Chicago region during the French control. However, these people were only temporary settlers and their records are very scant.

According to the Indians, the first white man who settled in Chicago was a Negro named Jean Baptiste Point De Saible. The Indians were accustomed to call all people white who were not of their own color. De Saible came to Chicago during the Revolutionary War and during his stay of seventeen years, he became well known to the Indian traders of Mackinac, Detroit and the surrounding territory. During this time the United States made a treaty with the Pottawatomie Indians, by which a piece of land six miles square was secured at the mouth of the Chicago River.

During the early part of the 19th century, John Kinzie, later known as the "father of Chicago," came to Chicago. He was a trader and besides his trading post in the village, he established several branch posts in the neighboring regions. The furs were brought to Chicago in most cases by pack horses, and were sent to Mackinac by boats where they were packed and sent to New York.

The American Fur Company had a station at Chicago, and a few years after the War of 1812 most of the fur traders of the Upper Mississippi, Illinois and Wabash Rivers and their tributaries were in their employ. The furs of the marten, silver gray fox, mink, muskrat, raccoon, lynx, wildcat, wolverine, badger, otter, beaver and many small animals were traded. Bear and deer skins were sent to the eastern markets. Reliable Indian hunters were given goods on credit in the fall and on their return they gave furs in payment.

The United States erected a government factory at Chicago in order that (1) liquor might be kept from the Indians, and (2) the Indians might secure a fair return for their furs and thus consider the United States as their friend. The factory was somewhat of a success before the War of 1812, but after the war it was a failure. The failure was due to several causes, the chief of which were (1) inexperienced people employed by the government who could not compete successfully with the British and American Fur Company traders, (2) government goods were unsuited for the Indian trade, (3) Indians were given liquor by the rivals of the United States and (4) the Indians usually distrusted the United States.

Thus during the first quarter of the 19th century, Chicago had very few houses or huts and practically all the people, except the sol-

diers, were connected with the fur trade. Fort Dearborn, which was destroyed during the War of 1812, had been erected a few years before on the south side of the Chicago River near the lake. It was rebuilt after the war. At this time the whole amount of trade carried on by means of the lake did not exceed the cargoes of five or six schooners.

The people "had the lake for coolness and beauty in summer, the forests for warmth and cheer in winter, masses of flowers in spring, and a few, very few fruits and nuts in autumn—whortleberries, cranberries, wintergreen berries, hazel nuts, walnuts, hickory nuts, beech nuts, etc. Then there was no lack of game for the hunting and the fish for the catching. The garrison had cattle, therefore there were doubtless fresh beef, milk and mutton."[1]

During the thirties, Chicago began to develop more rapidly. The fears of the Indian wars had disappeared, the Erie Canal in New York had been opened and a large tide of immigration moved rapidly westward. Boats were soon coming to Chicago from Buffalo, and by 1833 the town was an important distributing point for immigrants and there was an average of 100 arrivals daily. Six years later there was a regular line of steamers from Buffalo to Detroit and Chicago. Heavy travel was encouraged and the fares from Buffalo to Chicago were $20 for first class, $10 for second class and $5 for steerage.

ILLINOIS AND MICHIGAN CANAL

Due partly to the great success of the Erie Canal, the building of canals began to be discussed and undertaken in many states. The people of Chicago, eager to take advantage of every opportunity, began to think seriously of constructing a canal between the Chicago and Illinois Rivers.

The idea of joining Lake Michigan with the Illinois River was nothing new. More than 150 years before, Joliet had suggested to the authorities in Canada that it would be possible to go from Lake Erie to the Mississippi River by water and that only one canal would be needed, namely, one joining the Chicago River to the Illinois River. On the other hand, La Salle, who visited the region a few years later, did not favor the building of a canal because he thought that (1) in dry seasons the Illinois River was navigable only to Fort St. Louis (Starved Rock), (2) the sand bar at the mouth of the Chicago River would interfere with boats and (3) horses would be better to carry goods between Fort St. Louis and Lake Michigan.

[1] Moses and Kirkland: History of Chicago.

A few years after the War of 1812, *Niles Weekly Register* urged the construction of a canal. In 1818 Illinois became a state and its northern boundary line was extended about 61 miles. One of the reasons given was that the proposed Illinois and Michigan Canal would be in one state. In 1823 Beck, in his "Gazetteer of Illinois and Missouri," showed that it would be considerably cheaper in both money and time to ship a ton of freight from St. Louis to New York by way of the proposed Illinois and Michigan Canal and the Erie Canal than by way of the Mississippi River and the Atlantic Ocean. In 1836 actual work on the canal began and it was finished twelve years later.

The Illinois and Michigan Canal joined the Chicago River about five miles from its mouth with the Illinois River at La Salle. It was approximately 100 miles long.

The Illinois and Michigan Canal was a very important factor in the growth of Chicago. Eastern people were drawn to the city and a large number of workers and much machinery were needed for the construction. Hence Chicago became the distributing point and property values were increased several fold. After the canal was completed, many of the workers settled on farms near the canal which made more trade for Chicago. A good means of transportation was furnished and passengers were carried. People moved to Northern and Central Illinois and the population more than trebled in Chicago during the first six years of the canal.

The building of the canal made it necessary to improve the Chicago River, which had a sand bar at its mouth, and which opened into Lake Michigan about one-half mile south of its present mouth. With the aid of Congress the river was straightened and deepened so that lake boats could enter, and lighthouses were constructed.

Before the construction of the canal, produce for export was brought to Chicago in wagons, some coming for a distance of several hundred miles. In the fall many wagons, some drawn by oxen, others by horses, could be seen headed toward Chicago. During the busy seasons, the streets were crowded with wagons, and there were so many teams on a few of the principal streets that they were almost impassable. The canal, and later the railroads, changed this and produce was brought chiefly to the city by water and rail. The conditions were so striking that some of the merchants thought that the canal would ruin the city.

The canal opened up a large territory which formerly did not depend upon Chicago. The farmers of Northern and Central Illinois could get more money for their crops at Chicago than at St. Louis

because the former city had better connections with the East. Thus much trade was diverted from St. Louis and New Orleans. The canal carried lumber, machinery, salt and merchandise to the Interior, while it brought to Chicago sugar, tobacco and other products from the South and grain and live stock from the North. When railroads were built the canal helped to regulate the rates. Up to 1866 the business of the canal increased, but since this date it gradually decreased owing to the competition of the railroads. Since 1879 the expenditures have surpassed yearly the receipts and today it is almost a negligible factor in commerce. The Chicago Drainage Canal, which was constructed both for sanitary and commercial purposes and which will accommodate large steamers, joins the Chicago River with the Illinois River near Lockport. This canal is an important link in the Lake to the Gulf Deep Water-way Project.

RAILROADS

According to Thwaites, the natural evolution of trails has been first the buffalo trace, then the Indian trail, next the pioneer's path widened and straightened to accommodate wagons, then the military road or the plank road and finally the railroad. Previous to the building of railroads, Chicago had roads leading in different directions. A stage road ran around the southern end of Lake Michigan to Michigan City, another road led to Milwaukee, there were two or more roads to Elgin and other points in the West and there were other roads leading to cities in Illinois and Indiana. Some people came by road all the way from New York. Some of the roads were planked at a cost of $1,000,000 to $1,500,000 per square mile.

Wagons furnished a slow and expensive means of transportation for the people doing business in Chicago so railroads were introduced. The same year that the canal was completed saw the opening of the first railroad, the Galena and Chicago, to a point on the Des Plaines River, about ten miles distant. Due to less expense, strap rails were used for a short time in place of edge rails. The strap rails consisted of an iron plate two and one-half inches wide and about three-fourths or seven-eighths of an inch in thickness, laid on oak ribbons, which in turn were placed flatwise on longitudinal timbers which were spiked securely to cross ties. Two years later the railroad reached Elgin and a little later it got to Galena. The first engine was called the "Pioneer" and the second "Chicago." This railroad furnished cheap transportation for the lead mines of the Galena district as well as for the farmers along the route.

Due to its strategic location at the end of Lake Michigan and to its commanding position in a very fertile region, railroads sought Chicago. While other cities were spending vast sums of money in obtaining railroads, Chicago spent almost nothing. By 1856 Chicago had rail connections with Galena, Rock Island, Burlington, Quincy, Alton, Cairo and with most of the important points on the Upper Mississippi River. Eleven different lines of railroads were represented and about 100 trains arrived and departed daily.

Railroads have done much in the development of the United States. In most cases, the farther land is from a railroad the less its value. As railroads were extended to the west and northwest of Chicago, new lands were opened and the hinterland of the city became larger. Before this time St. Louis was a larger city than Chicago and it controlled most of the trade of the Upper Mississippi Valley, but as railroads entered this territory from the East it gradually lost the trade, and by 1870 Chicago surpassed St. Louis in population.

Another factor that entered into railroad building about this time was the introduction of the Bessemer process of making cheap, durable steel rails. Before this period iron rails were used and the average life was about eighteen months. Then the rails had to be taken up and replaced with new ones. Even before the rails were taken up they became rough, and cars passing over them were damaged by having the wheels torn and the nails and bolts loosened and broken. The largest cars could carry only about ten tons. Hence this meant a rather high freight rate. The steel rail will outwear about ten iron rails, three or four times as many tons may be carried and the cars will last longer. Thus the United States was given better transportation and cheaper freight rates.

Gradually railroads have been built to and from Chicago. Due to the long north and south extent of Lake Michigan, railroads between the Northwest and the East must pass around the southern bend of the lake and Chicago, being near this place, has benefited thereby. Today Chicago has twenty-seven large railway systems, besides several belt lines and electric lines, and forty per cent of the railway mileage of the United States terminates here. All trains end at Chicago and a passenger train a minute arrives and departs from the railway stations daily.

LUMBER

Due to the location of Chicago at the head of Lake Michigan and on the edge of the prairies, the city at an early date was an important

lumber center. Logs were floated down the streams to the mouths of rivers in Michigan and Wisconsin and there sawed into lumber. The lumber was transported over Lake Michigan to Chicago. As a large part of the territory to the west of Chicago was a prairie, lumber was needed for fences, buildings and furniture, and as the region became settled more densely, the demand for lumber increased. In 1840 the towns on the Upper Mississippi and its brances received lumber from the Allegheny River, a distance of 1200 miles. The average price of lumber at St. Louis was $40 per thousand feet, at Chicago $14. After the Illinois and Michigan Canal was built, much lumber was carried to the regions near the canal.

Chicago is at the present time the largest lumber market in the world. Not only a huge quantity of lumber is handled but also a large variety. Mahogany and other expensive woods from the tropics, as well as hard and soft woods from all parts of the United States and southern Canada are found here.

Due partly to being a great lumber market, as well as for causes to be mentioned later, Chicago is the greatest furniture market in the world.

GRAIN

At the time when Chicago began to grow rapidly, the prairies to the south and west were being settled. The prairies were settled after the timber lands because (1) they were believed to be infertile, (2) there was lack of timber for fuel, buildings, etc., (3) there was lack of running water, (4) they were difficult to plow, (5) there was long coarse grass, (6) they were exposed to the cold winds and (7) in many cases they were drained poorly.

With the settlement of the prairies, wheat and corn were raised and Chicago became a grain port. The grain was brought to the city and exchanged for things needed or sold. Thus Chicago became an important distributing point between the grain producing West and the manufacturing East.

Two of the outstanding factors which aided the settling of the prairies and thus the growth of Chicago were the reaper and the steel plow. By the middle of the 19th century, these farming implements were being manufactured in Chicago for the nearby farms. These machines permitted more work to be done on the farms with less men. It greatly influenced immigration and made farming less difficult.

The settlements to the west of Lake Michigan hauled grain in wagons to the nearest port from Chicago to Green Bay for shipment

to the East. Such ports were Kenosha, Racine, Milwaukee, Port Washington, Sheboygan and Green Bay; each being nearer Buffalo than Chicago. However, Chicago soon surpassed all these ports on account of better transportation and a larger area from which to receive grain. Since Chicago was a distributing point for eastern merchandise, ships could carry cargoes to Chicago and get return cargoes, while to the other ports full cargoes seldom were carried.

For some years St. Louis was the leading grain center of the Mississippi Valley, but after the building of the Illinois and Michigan Canal and railroads, St. Louis lost much of its trade because Chicago had better connections with the East. Even before the Civil War, the grain passing by New Orleans was on the decrease. Today, Chicago is the natural center of the greatest grain producing region of the world and many industries which use grain are found in the city.

MEAT PACKING

In the early days of western agriculture, scarcity of money among the farming people caused them to market their crops as soon as they were raised. However, it gradually was seen that the farmers could turn their corn into meat profitably and thus the beef and pork industry arose.

At first only a few animals were driven to Chicago to be slaughtered for local use. Gradually winter packing was done for outside markets and several slaughter houses were erected. As railroads were constructed, stockyards were built near them and many animals were received. Later the Union Stock Yards were built, which cover about one square mile and will accommodate many thousand animals.

Previous to 1860, packing pork and beef in barrels was done chiefly in the winter, but from this time on packing was done during the entire year. At this date, Cincinnati, known as "Porkopolis," surpassed Chicago in pork packing, but two years later it was surpassed by Chicago.

The Civil War created a great demand for meat products and Chicago furnished much of the supply. Shortly after the war the invention of the cooling process and the refrigerator car brought a larger territory to be supplied from Chicago, in fact, this territory includes various parts of the world.

Today, farmers are depending more and more upon the meat packing centers for their meat. Where only a few animals are killed, much of the so-called refuse is wasted, but in a large establishment it is used. The value of the so-called refuse is so great that the live animal may

be shipped to Chicago from a distance of several hundred miles, and it may go back at a lower price than it could have been produced at home. The city furnishes a ready market for all the by products, while a smaller place does not.

At the present time the value of the slaughtering and packing business of Chicago far outranks that of any of the other industries of the city, it is from one-third to one-half of the total value of all the industries. Chicago is the largest meat packing center in the world.

MANUFACTURING

One hundred years ago, Illinois had very few factories, no railroads, canals, gas, steam or electrical power. It was the day of the hunter, the trapper, the fisher and the home manufacturer. Today, Illinois is the leading industrial state east of the Appalachian Mountains and Chicago is the leading manufacturing city. Some of the factors influencing the development of a manufacturing city are (1) distribution of raw material, (2) availability of power, (3) good transportation facilities, (4) accessibility to markets, (5) abundance of labor, (6) favorable health and climatic conditions and (7) ready capital. Chicago is well favored with all these. As has been said, Chicago has the finest railroad transportation in the world and it is well situated in respect to water transportation. Its markets are the entire United States, and within a night's ride from 40,000,000 to 50,000,000 people are found. Hence there is plenty of labor. The death rate is low, sanitation is good, the lake offers a bountiful supply of water and the climate is favorable for an industrious, thriving people. Capital has been seeking Chicago and new factories are opened every year. Raw material such as iron, copper, lead, zinc, lumber, hides and grains are found near the city. The city is well situated in respect to power. Water power is found within a few miles and the amount may be increased. Chicago is on the edge of the coal fields of Illinois and coal may be imported easily from the East. Petroleum is piped and carried in cars from the fields of southern Illinois and the West.

At an early date, due to scarcity of labor and capital, manufacturing was confined to inexpensive articles such as the transforming of cheap lumber into sashes, doors, flooring, etc. Gradually capital and labor became more abundant and the manufacturing industries became more complex.

As the United States has increased in power, iron and steel goods have become more common, and it has been said that a nation's greatness may be determined by the amount of iron and steel used.

About the middle of the 19th century rich deposits of iron ore in the Superior region were discovered. These were within 350 to 400 miles of Chicago and the ore could be mined easily and shipped by water. Hence Chicago became an important steel manufacturing region and large boats carry the ore to the Chicago territory where everything is made from nails to steamship plates and railroad cars. Many industries depend upon iron and steel and today the iron and steel interests of Chicago have outgrown those of Pittsburgh.

WHAT OF THE FUTURE?

The future of Chicago is bright, in fact, it is probably brighter than that of any other city in the United States. Cities can prosper only as the surrounding country prospers. Improvements are being made in farm machinery which enables fewer men to work on the farms and more to live in the cities. Farming is becoming a science and more food may be produced with less labor and on less ground. Cities must exchange their products for those of the farm. Only about one-half of the arable land of the United States is cultivated and much of this is not cultivated scientifically. Hence this nation is able to support several times its present population and cities will increase accordingly.

When the deep water-way is an actuality between Lake Michigan and the Gulf of Mexico, when the Welland Canal, the St. Lawrence River and the Erie Canal are deepened, widened and improved sufficiently, Chicago will become the greatest inland ocean port in the world and perhaps the largest city. It will have its choice of three water routes to the Atlantic Ocean. Already Chicago is preparing for such a time, for it has constructed the Chicago Drainage Canal deep enough for large boats. It has a large municipal pier and two good harbors, one being at the mouth of the Chicago River and the other one at the mouth of the Calumet River. On account of its water routes, Chicago always will have cheap land transportation.

Since Chicago is in the best farming section in the world which is blessed with many natural resources and which is capable of supporting several times its present population, since it has the best land and water transportation of any city in the United States, since it is well situated in respect to natural resources such as coal, water power and iron, since the climate is neither too cold nor too hot, too wet nor too dry, and since the spirit "I will" permeates every true Chicagoan, we are forced to conclude that Chicago's remarkable growth and bright future is not so difficult to understand—it is merely due and will be due to man making

use of, and adapting himself to the natural geographic factors of the region.

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FORTY-EIGHT STATES AND THEIR POPULATION IN 1920

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Many interesting and instructive facts related to geography, history, economics, and other subjects of the school curriculum are obtained from the United States Census reports published by the federal government every ten years. On January 2, 1920, an army of 70,000 census enumerators began the work of gathering data for the Fourteenth Census. It will require about three years to tabulate, classify, interpret, and publish in final form all of these census reports. The census work is concerned in securing complete and accurate data concerning five subjects: (1) population, (2) agriculture, (3) manufactures, (4) forestry and forest products, and (5) mines and quarries.

Population figures are the first to be made available. While final publication cannot be accomplished for many months after the count is made, preliminary reports have been made almost daily since February, 1920. These reports were prepared as rapidly as results accumulated at the Bureau of the Census in Washington. They were then sent in the form of mimeographed sheets to the newspapers of the country and to others who are interested in the progress of the census.

In October, 1920, preliminary reports of population were made for Continental United States, the 48 states, the one federal district, and for the 288 cities having a population of 25,000 or more. This article is based on the report of population for the 48 states and the District of Columbia. Population figures are given in round numbers to even thousands. The material is presented in a form convenient for use in geography classes.

The population of Continental United States on January 1, 1920, was 105,683,000, a gain over the 1910 population of 14.9 per cent. In referring to the number of states, we shall use 49 as the total number in order to include the District of Columbia which occurs in census reports along with the 48 states and is given rank among the states. Of the 49 states, 46 increased in population and 3 had small decreases. The decreases were 5.5 per cent for Nevada, 1 per cent for Vermont, and .4 of one per cent for Mississippi. The decreases in actual numbers were 4,468 for Nevada, 3,535 for Vermont, and 7,730 for Mississippi. The percentage of increases varied from 2.9 per cent for New

Hampshire to 63.1 per cent for Arizona. The actual increase in numbers varied from 20,000 for Delaware to 1,270,000 for New York. Pennsylvania and California are the only other states whose gains were over 1,000,000. The percentages gained by these three states are 13.9 for New York, 13.8 for Pennsylvania, and 44.1 for California.

STATES IN ORDER OF POPULATION

In the following list, the states are numbered and named in order of rank in population. The District of Columbia is included, thus making 49 in number.

1. New York, 10,384,000. 2. Pennsylvania, 8,720,000. 3. Illinois, 6,485,000. 4. Ohio, 5,759,000. 5. Texas, 4,661,000. 6. Massachusetts, 3,852,000. 7. Michigan, 3,667,000. 8. California, 3,426,000. 9. Missouri, 3,403,000. 10. New Jersey, 3,155,000. 11. Indiana, 2,930,000. 12. Georgia, 2,894,000. 13. Wisconsin, 2,631,000. 14. North Carolina, 2,556,000. 15. Kentucky, 2,416,000. 16. Iowa, 2,403,000. 17. Minnesota, 2,386,000. 18. Alabama, 2,347,000. 19. Tennessee, 2,337,000. 20. Virginia, 2,306,000. 21. Oklahoma, 2,027,000. 22. Louisiana, 1,797,000. 23. Mississippi, 1,789,000. 24. Kansas, 1,769,000. 25. Arkansas, 1,750,000. 26. South Carolina, 1,683,000. 27. West Virginia, 1,463,000. 28. Maryland, 1,449,000. 29. Connecticut, 1,380,000. 30. Washington, 1,356,000. 31. Nebraska, 1,295,000. 32. Florida, 966,000. 33. Colorado, 939,000. 34. Oregon, 783,000. 35. Maine, 768,000. 36. North Dakota, 645,000. 37. South Dakota, 635,000. 38. Rhode Island, 604,000. 39. Montana, 547,000. 40. Utah, 449,000. 41. New Hampshire, 443,000. 42. District of Columbia, 437,000. 43. Idaho, 431,000. 44. New Mexico, 360,000. 45. Vermont, 352,000. 46. Arizona, 333,000. 47. Delaware, 223,000. 48. Wyoming, 194,000. 49. Nevada, 77,000.

A STUDY OF STATE POPULATIONS

The following exercises are appropriate for geography classes who are now studying or who have previously studied the United States.

1. Complete this table:

Number of states having more than 4,000,000 inhabitants	
Number of states of the 3,000,000 group	
Number of states of the 2,000,000 group	
Number of states of the 1,000,000 group	
Number of states having between 500,000 and 1,000,000 inhabitants	
Number of states having less than 500,000 inhabitants	
Total	49

2. On an outline map of the United States enter the population of each state. As you write the numbers, endeavor to think of reasons which give the state the population which it has.

3. How many of the 49 states lie east of the Mississippi? West of the Mississippi? Include Louisiana and Minnesota among the states west of the Mississippi.

4. Of the first 25 states in population, how many are east of the Mississippi? West of the Mississippi?

5. Compare the populations of the groups of states as these groups are shown in your geography textbook. Find, by computation, the

population of each group, then write out statements based on the results.

6. How many of the states having the smaller number of inhabitants must be combined to contain approximately the same number of persons as the most populous state?

7. Compare the total population of the eleven Western States with that of New York State.

8. About one-third of the area of the United States lies east of the Mississippi River. What per cent of the population lives east of the Mississippi? West of the Mississippi?

9. What per cent of the population is found in the 11 Western States? In the 11 most populous states? In the states east of the Mississippi and north of the Ohio, including Pennsylvania, New Jersey and all states north of them?

DENSITY OF POPULATION AMONG THE STATES

1. The comparative ability of two regions to support a large population is not determined by a comparison of populations alone, but by a comparison of populations in relation to area, that is, by a comparison of *density of population*. The density of population is expressed as so many persons to a square mile. In 1920, the density of population for New York State was 217 persons per square mile.

2. Altho New York is the most populous state, it may not be the most densely populated state. For Massachusetts we have this problem: $3{,}852{,}356 \div 8{,}039 = 479$. The density of population for Massachusetts is thus more than two times that of New York.

3. The problem for Rhode Island is also an interesting one: $604{,}397 \div 1{,}067 = 566$. Rhode Island is the most densely populated state in the United States.

4. The density of population in the District of Columbia is greater than that of any state. This is because the District of Columbia is also a city, for the city of Washington includes all of the 70 square miles of the District of Columbia, 60 square miles of which are land. The density of population is 7,292. In making comparisons of density of population among states the District of Columbia is not to be considered. It may be properly used only in comparing density of population of cities. Thus Chicago, with an area of 200 square miles, has a population of 2,701,705. Compute its density of population and compare with that of the city of Washington or the District of Columbia.

5. Compare the density of population for California and Nevada, and account for their difference. Select other pairs of states for comparison and explain their relative densities.

6. The following table gives the density of population for the 48 states in 1920 in whole numbers in order of rank in density of population. As you read the list, locate the state, and note carefully which part of the United States is represented.

1. Rhode Island, 566. 2. Massachusetts, 479. 3. New Jersey, 420. 4. Connecticut, 289. 5. New York, 217. 6. Pennsylvania, 194. 7. Maryland, 145. 8. Ohio, 141. 9. Illinois, 115. 10. Delaware, 113. 11. Indiana, 81. 12. Michigan, 63. 13. West Virginia, 60. 14. Kentucky, 60. 15. Virginia, 57. 16. Tennessee, 56. 17. South Carolina, 55. 18. North Carolina, 52. 19. Missouri, 49. 20. Georgia, 49. 21. New Hampshire, 49. 22. Wisconsin, 47. 23. Alabama, 45. 24. Iowa, 43. 25. Louisiana, 39. 26. Mississippi, 38. 27. Vermont, 38. 28. Arkansas, 33. 29. Minnesota, 29. 30. Oklahoma, 29. 31. Maine, 25. 32. California, 22. 33. Kansas, 21. 34. Washington, 20. 35. Texas, 17. 37. Florida, 17. 37. Nebraska, 16. 38. North Dakota, 9. 39. Colorado, 9. 40. Oregon, 8. 41. South Dakota, 8. 42. Utah, 5. 43. Idaho, 5. 44. Montana, 3. 45. New Mexico, 3. 46. Arizona, 3. 47. Wyoming, 2. 48. Nevada, 0.7.

7. On an outline map of the United States enter the numbers indicating density of population for each state. Select five colors grading from light to dark and color the map to show the density of population as follows:

I. States having 1-10 persons per square mile
II. States having 11-25 persons per square mile
III. States having 26-50 persons per square mile
IV. States having 51-100 persons per square mile
V. States having over 100 persons per square mile

9. Note carefully the regions of the United States in which the states of each group are found. Account for the general location of groups.

10. Select individual states and give the reasons for their density. Compare the density of population in different states and account for their difference.

11. Why are three of the New England States so much more densely populated than the other three?

12. What would be the population of Texas if it were as densely populated as Massachusetts?

13. Why does Nevada have a smaller population and a smaller density of population than any of its adjoining states?

14. Why are Washington and California more densely populated than Oregon?

15. Why are the 3 Pacific Coast States as a group more densely populated than the 8 Plateau States as a group?

16. Can the western half of the United States ever support as dense a population as the eastern half? Give reasons.

17. Make and solve other problems based on a study of the population and the density of population of the states.

A GEOGRAPHIC MAGAZINE AS A CLASS PROJECT

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This project was worked out by the 6A class of the Alger School, Detroit, Michigan, with the assistance of the other geography classes.

AIM

To correlate the work of the various geography classes by having each class contribute something toward the enjoyment of all and at the same time profit by their work and give useful and interesting information to others.

SITUATION

The 6A class had been studying the new countries of Europe for several weeks and with the aid of magazines, newspapers, maps, etc., had prepared some very fine recitations. One day in class someone mentioned the fact that it would be nice if the information which the various members of the committees had secured with such difficulty might be passed on to the other classes. A number of suggestions were made. One of the girls suggested that other classes often had recitations that were just as interesting as those given in the 6A class, and proposed that a magazine or paper be published with the cooperation of all these classes. She was told that there were no objections and that it was a very fine idea if it could be carried out. The class was sure that it could be and wanted to organize at once. However it was decided that they wait until the next day and consult a number of the magazines and newspapers before doing anything definite.

ORGANIZATION AND PLANNING

The next day a chairman was chosen to take charge of the organization work. The name of the magazine was the question of first importance. A long list was suggested but the title, "The Alger Geographic," received a majority of votes. Then the officers and departments necessary for carrying out their plans were taken up. The following were decided upon after a great deal of discussion:

OFFICERS

1. Editor-in-chief
2. Assistant Editor
3. Business Manager
4. News Editor
5. Jokes
6. Cartoonist
7. Artist
8. Question and Answer Editor

DEPARTMENTS

1. Editorial
2. News
3. Jokes
4. Art
5. Question and Answer

There were to be two reporters from each class who were to hand in the class news, jokes and other contributions from their respective classes, to the head of each department. Each officer had the privilege of selecting two assistants, thus forming a committee of three to arrange and pass judgment on the papers handed in. A continued story plan was adopted and given the title of "Around the World." It was to follow the travels of a little girl in different parts of the world.

The magazine was to be published in typewritten form every two weeks at first, but it proved to be more of a task than was expected, so it is now published only once a month. A regular meeting of all the officers and reporters is held at the beginning of each month and once just before it is published to correct errors, etc.

RESULTS

The magazine has been a source of great interest to everyone. The classes can hardly wait for their turn to come when a number is published. Each room is allowed to have it three days and a part is read each day during the study period. Quite often the request to take it home is made but has to be refused.

The children seem as anxious and pleased at having their work shown in this form as if they were really having it printed. But do not think for a moment that they are always satisfied. They are not. Very often this comment is heard, especially from the boys: "Oh, that's all right, but I think he (or she) could have done better if they had done so-and-so." These criticisms are not passed by but are taken up at the regular meetings and carefully considered. So far they have in most cases proven very helpful.

CONCLUSIONS

The work on this project has not only been intensely interesting but has shown very clearly what children expect and enjoy. It has been carried out much more efficiently than was expected and is being improved so rapidly that there is no doubt about the fact that it is thoroly worth while. It offers many opportunities for correlation especially with the art and literature departments in the school. Originality receives great encouragement and thus gives the individual child a chance to show powers no one dreamed he possessed.

LITTLE KNOWN URUGUAY

Among "well read" people a considerable number will be found who know that somewhere in South America, there exists a country known as Uruguay. Their impression of this country (they will have no knowledge of it) will be that "Anyway, it doesn't amount to much"; which impression is largely correct, tho not entirely so.

This little country with the area of Missouri and less than half the population is—with the exception of its big neighbor, Argentina—the only country of all South America in which white people outnumber non-whites; ninety percent of the people are white, eight percent mixed bloods, and two percent Indians and Negroes. In several countries of South America, only eight percent to ten percent of the people are white. In Uruguay, half of the people can read; only the Catholic church is tolerated, and the national university at Montevideo is good, as Latin-American universities go. The form of government is set down as a republic, but thruout most of the history of the nation there have been frequently recurring armed conflicts between the two political factions. Despite this chronic turbulence, the country has prospered and the average wealth of the people is high. Montevideo is one of the great ports of South America, with a ten million dollar dock system and 3,000 incoming steamers a year—peace times.

Uruguay is a nation of a single industry—stock raising. True, agriculture exists and is increasing; but of the $152,290,000 of exports in 1919, $139,900,000 consisted of animal products: wool, meats and extracts, hides and skins. Agricultural exports were only a little more than two and a half million dollars. The imports in 1919 amounted to only $43,500,000, yet this was more than $30.00 per capita. The rural life of the nation almost begins and ends in one dominating occupation—that of grazing. Only five percent of the land is used for agriculture. There are almost no forests. The country is one great pasture on which graze 8,000,000 cattle, 12,000,000 sheep, (26,000,000 in 1908) and a million other animals.

The Chicago meat packers have large plants in Uruguay, but the biggest concern is the enormous plant of the Liebigs, a German concern, mainly engaged in the production of beef extract. Before the war the Liebigs slaughtered 2,000 to 3,000 cattle daily, and in the "Greatest Kitchen in the World" reduced them to beef extract and by-products.

So greatly does Uruguay's production of certain commodities exceed its own needs that its exports amount to nearly $120.00 per capita. Its total foreign trade is $152.00 per capita, which is more

than double that of the United States prior to the recent war. The tonnage entering and clearing the port of Montevideo is greater than that entering and clearing the principal port of France—Marseilles.

The climate is delightful for people but precarious for crops. The little country is in the warm part of the temperate zone and is half surrounded by the mild water of the South Atlantic. On its coast are the greatest bathing resorts of South America. The rainfall is exceedingly erratic and this plays havoc with the flocks. Sometimes a scorching drought settles down upon the land, the pastures dry up, and sheep and cattle perish by the millions. In 1914 600,000 cattle and 5,000,000 sheep died from disease and starvation, and in 1916 a million and a half cattle perished. Another but less disastrous drought occurred in 1917. Nearly every summer, swarms of locusts invade the country as they do in Argentina and devour every green thing in their path. In 1917, the army was called upon to furnish men to combat the locusts. In spite of these drawbacks the country is increasing in wealth rapidly.

Before the war, Germany, Great Britain, and France had most of the trade; now the United States is far ahead of any other nation both in the import and the export trade of Uruguay.

R. H. WHITBECK

SUMMER SESSION COURSES IN GEOGRAPHY, 1921

COMPILED BY F. E. WILLIAMS
University of Pennsylvania

The following is a list of courses in geography to be given in the summer sessions of the educational institutions from which definite reports have been received.

Northern Arizona Normal School, Flagstaff, Ariz.
- Review of Geography for Teachers
- Field Geography (Region near Flagstaff)
- Economic Geography
- (Names of instructors were not reported.)

University of California, Berkeley, Cal.
- The Geography of California. Miss McClellan
- The Teaching of Geography. Miss McClellan

University of California (*Southern Branch*), Los Angeles
- The Geography of South America. Miss Clark
- Geographic Regions of the World. Miss Clark
- Political Geography. Mr. Whittlesey

State Normal School, Chico, Cal.
- Methods of Teaching Geography. Mr. Studley
- Geography and World Power, or Geography of California. (Especially Mt. Shasta region.) Mr. Studley

University of Colorado, Boulder, Colo.
- Earth Science, Professor McCourt and Assistant Professor Thomas

Geographic Influences. Professor McCourt
Geography and Commerce. Assistant Professor Thomas.
Field Course. Professor McCourt and Mr. Kreps. July 25 to Aug. 20 in Rocky Mt. region.
Climatology. Assistant Professor Thomas
Geography of North America. Assistant Professor Thomas
Political Geography. Assistant Professor Thomas
Field trips every week end include one to Arapahoe Peak and one to Estes Park.

University of Georgia, Athens, Ga.

Geography Review. Miss Pitts
Elementary Geography. Miss Scoville
Advanced Geography. Miss Pitts
Economic Geography. Miss Pitts

University of Chicago, Chicago, Ill.

Elements of Geography. Assistant Professor Colby
Principles of Human Geography for Grade Teachers. Professor Calkins
The Technique of Teaching Geography in the Grades. First Term; repeated Second Term. Miss Parker
The Organization of Geographic Problems. First Term; repeated Second Term. Professor Calkins
The Supervision of Geography in the Grades. Miss Parker
Economic and Commercial Geography. Assistant Professor Colby
Geography of North America. Second Term. Dr. Platt
Field Course: Geography of Chicago and Its Environs. Assistant Professor Jones
Field Course in Green Bay, Wisconsin, Region. First Term. Dr. Platt
Geography of the British Isles. Professor Fairgrieve (London Day Training College)
Influence of Geography on American History. Professor Barrows
The Geographical Factor in History. Professor Fairgrieve
Conservation of Natural Resources. Professor Barrows
Geography of Southern Asia. Assistant Professor Jones
Pro-Seminar in Geography. Professor Barrows, Assistant Professors Jones and Colby.

Two field courses will be offered by the University of Chicago. The first involves a study of the significance of geographic conditions in the economic life of the Chicago District, and serves as an introduction to geographic field work. The second course, which affords further training in methods of work, will be conducted in the Green Bay region of northeastern Wisconsin, an area in which there is variety in topography, soil, mineral resources, native vegetation, and to some extent in climate, with resultant variety in occupations and productions. Four weeks will be spent in the field, beginning June 20.

Chicago Normal College, Chicago

Commercial and Industrial Geography. Mr. Branom
The Teaching of Geography. Mr. Branom
The Geography of Europe. Mr. Branom

Illinois State Normal University, Normal

Physical Geography. First Term. Mr. Strong
Geography Method for Country Schools. First Term. Mr. Strong
Home Geography. First Term. Miss Tortat
Intermediate Geography. Both Terms. Miss Tortat
Geography of North America. First Term. Miss Strong
Geography of Eastern Continents. First Term. Mr. Russell
Commercial Geography. Both Terms. Mr. Russell; Miss Strong
Geographic Influences in American History. First Term. Miss Strong
Climatology. First Term. Mr. Ridgley
Geography of Illinois. First Term. Mr. Ridgley.

Geography of Europe. Second Term. Miss Strong
Human Geography. Second Term. Mr. Russell

State Normal School, DeKalb, Ill.
Elements of Geography. Mr. McFarland
Commercial Geography. Mr. McFarland
Regional Geography. Mr. McFarland

State University, Iowa City, Iowa
Physiography. First Term. Associate Professor Thomas, Miss Fillman
Baraboo Field Course, Elementary. First Term. Mr. Wentworth
Black Hills Field Course, Elementary and Advanced. First and Second Terms. Assistant Professor Runner
Northern Iowa. Field Course. Associate Professor Thomas

Western Kentucky State Normal School, Bowling Green, Ky.
Geography, Emphasis on Eurasia. Miss Jeffries
Physical Geography. Miss Jeffries
Method in Geography. Miss Jeffries
Geographic Influence in American History. Miss Jeffries

University of Michigan, Ann Arbor, Mich.
Teachers' Course in Physiography
Elementary Meteorology
Geographic Influences
Commercial Geography
Research and Special Work
Field Courses in Geology and Geography
Professors Scott and Sauers; Instructors Ehlers, Hussey, and McMurray

The summer field course in geography will be lengthened this summer to a period of six weeks, beginning July 5. In addition to the work in the Highland Rim and Cumberland Plateau of Kentucky, the Valley of East Tennessee and the Blue Grass will be included. More time will be given also to the systematic work at the camp site at Mill Springs. Professor C. O. Sauer will again have charge of the camp, which includes also a geological party under separate instruction.

Western State Normal, Kalamazoo, Mich.
General Geography. Mr. Wood
Geography of North America. Mr. Wood
Economic and Commercial Geography. Mr. Wilcox

Michigan State Normal College, Ypsilanti, Mich.
Elementary Geography. Professor Jefferson
Teachers' Course in Geography. Professor Jefferson
Special Geography of France. Professor Jefferson

State Teachers College, Mankato, Minn.
Principles of Geography. Mr. Watson
Geography of North America. Mr. Watson
Laboratory and Field Work. Miss Lynch

University of Missouri, Columbia, Mo.
Teaching of Geography.
(Names of instructors were not reported.)

Southeast Missouri State Teachers College, Cape Girardeau
General Geography
Physiography
Teaching of Geography
Commercial-Industrial Geography
Geographic Influences
(Names of instructors were not reported.)

University of Montana Missoula, Mont.
Physiography. Professor Rowe
Geography and Geology of Montana. Professor Rowe

University of Nebraska, Lincoln, Neb.
General Geography. First Term. Professor Bengtson
Geography of Europe. First Term. Professor Bengtson
Field Geography. First Term. Professor Bengtson
General Geography. Second Term. Miss Anderson
Geography of Nebraska. Second Term. Miss Anderson
Field Geography. Second Term. Miss Anderson

Rutgers College and the State University of New Jersey, New Brunswick, N. J.
Methods of Teaching Geography in the Elementary School.
(Names of instructors not reported.)

Cornell University, Ithaca, N. Y.
Physical Geography. Assistant Professor Williams
Commercial and Industrial Geography. Mr. G. J. Miller
The Teaching of Geography. Mr. G. J. Miller
Mathematical Geography. Assistant Professor Williams
Physical Geography, Laboratory Course. Mr. Carlson
Geography and Geology, Field Course

Columbia University, New York City
Physical Geography and Its Economic Aspects. Professor Wright
Physiography of the Western United States. Professor Wright
Geographic Delineations and Map Interpretations. Professor Lobeck
Geography of Europe. Professor Lobeck
Field Work in Physiography. Professor Lobeck
Mathematical Geography. Professor Jacoby
Economic Geography. Mr. Orchard
The Teachers College offers the following courses:
The Teaching of Geography in the Lower Grades. Mr. Stull
The Teaching of Geography in the Upper Grades. Mr. Stull
The Supervision of Geography in the Grades. Mr. Stull

New York University, New York City
Economic Geography of Europe
Commercial and Industrial Geography
Geography (Field Course)
Research in Geography and Geology
(Names of instructors were not reported.)

Syracuse University, Syracuse, N. Y.
Industrial and Commercial Geography
Principles of Economic Geography
(Names of instructors were not reported.)

University of North Carolina, Chapel Hill, N. C.
Elementary Geography
The Teaching of Geography in the Grades
Commercial and Industrial Geography
The Teaching of Geography in the High School
(Names of instructors were not reported.)

Ohio University and State Normal School, Athens, Ohio
Methods in Geography. (Grammar Grades)
Methods in Geography. (Primary Grades)
Physical Geography
(Names of instructors were not reported.)

Cleveland School of Education, Cleveland, Ohio
The Teaching of Junior High School Geography. Professor Gregory
Field Studies in the Geography and Industries of Cleveland. Professor Gregory
Industrial and Commercial Geography. Miss Matchett
Regional Geography of the United States. Miss Matchett
Elementary School Geography. Miss Sherman
Methods in Elementary School Geography. Miss Sherman
Demonstration Lessons in Elementary Geography. Miss Sherman
Ohio State University, Columbus, Ohio
Introduction to Geography
(Names of instructors were not reported.)
Miami University, Oxford, Ohio
Geography for Teachers in Primary Grades
Geography for Teachers in Intermediate Grades
Junior High School Geography
Professor McConnell and Miss Finch
University of Pennsylvania, Philadelphia, Penn.
Geography in the Department of Education
The Pennsylvania State College, State College, Penn.
Physical Geography
Teachers' Geography
(Names of instructors were not reported.)
University of South Dakota, Vermillion, S. D.
Geography (Normal Course). Miss Hollister
University of Tennessee, Knoxville, Tenn.
Methods of Teaching Primary Geography
Methods of Teaching Geography in the Grammar Grades
Secondary Geography
Teaching Geography in the High Schools
George Peabody College for Teachers, Nashville, Tenn.
Climate and Man. Mr. Parkins and Miss Walker
Economic and Commercial Geography of the United States. Mr. Marston.
Teaching of Geography. Mr. Marston
Economic and Commercial Geography of Leading Foreign Countries. Mr. Marston
Geography of North America. Mr. Parkins and Miss Walker
Geographic Influences in American History. Mr. Parkins and Miss Walker
Geography Study Tour, Great Lakes Region. Mr. Parkins
Geography Seminar. Mr. Parkins
Baylor University, Waco, Texas
Geography. Miss Deal
Physical Geography, Mr. Faubian
Geography. Mr. Oliver
Geology. Mr. Poague.
Geography. Miss Tanner.
University of Utah, Salt Lake City, Utah
Primary Art Methods—Application to Geography
Elementary School Methods of Geography and History
University of Virginia, Charlottesville, Va.
Economic Geography. First Term. Miss Kelly.
Laboratory and Field Work. First Term. Miss Kelly
Methods in Geography. Second Year Grammar Grades. Both Terms. Miss Kelly
University of Washington, Seattle, Wash.
Fundamentals of Geography. Professor Saunders

College Physiography. Professor Landes
Economic Geography. Professor Landes
Physiography of the United States. Professor Saunders

University of Wisconsin, Madison, Wis.

Geography of Europe. Professor Whitbeck
Geography of South America. Professor Whitbeck
Advanced Economic Geography. Professor Whitbeck
Commercial and Industrial Geography (U. S. not included). Professor Finch
Agricultural Geography. Professor Finch
Geographical Seminary (a study of the Tropics). Professor Finch
Physical Geography. Mr. Blanchard
Glaciers and Glaciation. Mr. Blanchard
Geography of North America. Miss Loft
Meteorology. Mr. Miller
Climatology. Mr. Miller
Field Course in Physiography and Geology (Devils Lake). Mr. Blanchard

The Department of Geology and Geography offers a month's field course in the Baraboo (Devils Lake) district of southern Wisconsin. Situated on the edge of the Driftless Area this region offers exceptional opportunities for the study and comparison of the glaciated and unglaciated areas, folded mountain structures, diverted drainage, wind gaps, unconformities, faults, monadnocks, glacial lakes, igneous, sedimentary and metamorphic rocks. Side trips will be taken to Ableman, Camp Douglas and the Dells of the Wisconsin River.

State Normal School, Oshkosh, Wis.

Elements of Geography. Professor Mitchell
Principles of Geography. Professor Mitchell
World Geography. Professor Mitchell
Methods Courses in Geography. Miss Bradbury

University of Wyoming, Laramie, Wyo.

Geography Methods
Regional Geography of Asia
(Names of instructors were not reported.)

GEOGRAPHICAL PUBLICATIONS

Frederick J. Turner. **The Frontier in American History**. 375 pp. Henry Holt & Company, New York. 1920. $2.50.

Professor Turner's book, "The Frontier in American History" is a publication in one volume of essays and addresses interpreting the significance of the frontier in American history. The first chapter is an essay which was read at a meeting of the American Historical Association in Chicago in 1893. The last chapter is an address delivered at the dedication of the building of the State Historical Society of Minnesota in 1918. The book as a whole shows the development of the interpretation of American history during this quarter of a century. The author considers the period of history covered in these essays and addresses the age of colonization, which came to a close with the disappearance of free land. The problem of the West is shown to be in essence the problem of American development. The influence of environment and the economic conditions have been considered in such a way as to be of the very greatest interest both to the teachers of history and of geography. The character of the American people who formed the waves of population which were continually moving westward, directly or indirectly shaped the development of institutions in the eastern as well as the western states, and had no little effect upon the spirit of the old world. During the first century of our national history, free land and the

independent spirit of the frontier determined largely the development of our democratic institutions. With the passing of the frontier new problems confront our government for a solution. Teachers and students who are interested in the study of these problems will be greatly helped by Professor Turner's book.

A. B. MORRIS

State Teachers College,
Mankato, Minn.

Mary J. Booth. **Material on Geography Which May be Obtained Free or at Small Cost.** 112 pp. Eastern Illinois State Normal School, Charleston, Illinois. 1920. Free.

This bulletin is a revised edition of a similar one published some years ago. It lists a vast amount of very valuable material which may be secured by the geography teacher free or at small cost. The material is arranged by states and countries under a "General List," and under the headings "Industrial and Commercial Products"; "Educational Exhibits"; "Photographs, Lantern Slides and Moving Pictures"; "Addresses of Dealers in Geographical Supplies" and "Miscellaneous." Miss Booth and the Charleston Normal School are to be congratulated on making this very valuable publication available to the schools of the country. Copies may be obtained free of charge by addressing the school.

————**World Atlas of Commercial Geology.** Part I. Distribution of Mineral Production. 65 pp. of text, 76 maps. U. S. Geological Survey, Washington. 1921. $2.00.

This atlas presents a great body of information never before available to American students. The following subjects are treated in the text and by colored maps: coal, petroleum, oil shale, natural gas, iron, manganese, chromium, nickel, tungsten, vanadium, molybdenum, copper, lead, zinc, platinum, gold, silver, phosphate, potash, nitrates, sulphur, pyrites, mercury, tin, antimony, arsenic, aluminum, graphite, magnesite, and mica.

Assunto Mori. **Atlante di Geografia Fisica Politica ed Economica.** Fascicolo I. Geografia generale—Europa ed Italia in generale—Spagna, Portogallo, Francia, Gran Bretagna e Irlanda. 9½ x 13½ inches. 300 maps, grafs and diagrams. G. B. Paravia E. C., Rome. 1918.

The world maps cover such subjects as, geology, magnetism, climate, vegetation, anthropogeography, and political features. Two plates are given to Europe with insert maps showing climate, geology, agriculture, minerals, population, language, and religion; two to Italy, and one each to United Kingdom, France, Spain and Portugal with similar inserts. The maps, diagrams, grafs, etc., are all in color and indicate high grade workmanship.

A. K. Lobeck. **A Physiographic Diagram of the United States.** Scale approx. 50 miles to 1 inch. A. J. Nystrom & Co., Chicago. 1921. Price varies with mounting.

"The physical features . . . . are represented . . . . as if seen in bird's eye view, but without distortion in area. . . ." The purpose of the diagram "is to present to the observer not only the topographic features but to suggest the underground structure and the type of rocks which control the topography."

Axel H. Oxholm. **Swedish Forests, Lumber Industry and Lumber Export Trade.** 282 pp., 116 maps, grafs, diagrams and photos. Special Agent Series No. 195. Bureau of Foreign and Domestic Commerce, Washington, 1921. 75 cents.

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VOLUME IX.

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THE JOURNAL OF GEOGRAPHY

A MAGAZINE FOR TEACHERS

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